

REMARKS

Claims 9, 17, 18, and 21 have been amended. Claim 24 has been canceled. Claims 27 and 28 have been added. Therefore, claims 9-23 and 25-28 are pending. Reconsideration and withdrawal of all outstanding rejections are respectfully requested in light of the foregoing amendments and the following remarks.

Claims 9, 10, 12, 13, and 15-26 stand rejected under 35 USC 103(a) as being unpatentable over U.S. Patent Pub. No. 2003/0058345 to Morris ("Morris") in view of U.S. Patent No. 6,115,065 to Yadid-Pecht ("Yadid"). Without acknowledging that either of the cited references represent appropriate prior art to the claimed invention, Applicant submits the following remarks to overcome this rejection.

The claimed invention, as embodied by independent claims 9, 18 and 21, relates to sampling pixel output signals multiple times during an integration period and storing each sampled value in a memory array located on a substrate with the pixel array. The sampled values are accumulated by the memory array(s) and represent an integrated signal for each pixel in the integration period. Further, independent claim 18 recites respective first and second digital memories for "accumulating said [respective] plurality of digital values in said [respective] digital memory, said accumulated [respective] plurality of digital values representing a [respective] digital integrated signal for said integration period of said [respective] pixel."

Morris is directed to a single chip digital camera system having at least one analog-to-digital converter (ADC), register file memory, and arithmetic logic unit (ALU) associated with a block column set of pixels in a pixel array. As acknowledged by the Office Action, Morris provides no teaching or suggestion relating to sampling multiple pixel output signals from the pixels during an integration period and storing and accumulating each sampled value.

Yadid relates to a method and apparatus for improving the dynamic range of image sensors by achieving more than one integration time for each pixel in the image

sensor for a given frame of an image. The Office Action states that “it would have been obvious to one of ordinary skill in the art at the time the invention was made to have Morris’s imaging device sample each pixel multiple times during an integration period.” Moreover, the Office Action states that the “frame” taught by Yadid is equivalent to the integration period in the claimed invention, and correspondingly, the “integration time” taught by Yadid is equivalent to a sample in the claimed invention. Applicants respectfully disagree.

To establish a *prima facie* case of obviousness, the Examiner must meet three criteria. “First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” MPEP §2143. The present combination of references does not meet these three criteria.

First, the cited references, whether considered alone or in combination, do not teach or suggest every limitation of the claimed invention. Claim 9 recites an imaging system wherein “each pixel in said active pixel image sensor array is sampled multiple times during an integration period and each sampled value is stored in one of said digital memory arrays, said stored values being accumulated and representing a digital integrated value for said integration period of said pixel.” Neither of the cited references teaches a digital memory array that stores sampled values that are accumulated to represent a digital integrated value for an integration period of a pixel.

Morris, as stated above, provides no teaching relating to sampling multiple signals from a pixel in an integration period. Nor does Yadid cure this deficiency. Yadid teaches sampling multiple integration periods for a pixel to create an image frame. The fact that this is different from taking multiple samples from a pixel during one integration period, as in the claimed invention, is established by Yadid’s teaching that the photosensitive regions is reset after each integration period. Col. 5, lines 18-50.

Moreover, Yadid does not teach aggregating the signals read out from the pixels, but rather, taking one signal from either the longer or shorter integration period depending on whether the detected pixel is associated with a bright or dark portion of the image. Col. 6, lines 24-31. Therefore, neither of the cited references teach or suggest the unique combination of elements recited by the claimed invention.

Similarly, independent claim 18 recites a method of acquiring an image comprising *inter alia*, “accumulating [a] first plurality of digital values in [a] first digital memory, said accumulated first plurality of digital values representing a first digital integrated signal for said integration period of said first pixel;... and accumulating [a] second plurality of digital values in [a] second digital memory, said accumulated second plurality of digital values representing a second digital integrated signal for said integration period of said second pixel.” None of the cited references, whether considered alone or in combination, teach or suggest the unique combination of elements recited by the method of claim 18.

Moreover, neither of the cited references provide the requisite motivation to combine the references as suggested by the Office Action. Although Yadid discusses improving prior art systems by sampling multiple signals from each pixel during a frame, Yadid’s teachings do not relate to a system such as that shown in Morris, having multiple register files and ALUs. In fact, Yadid teaches away from a multiple memory design, stating that it results in “reduced fill factor since two storage sites occupy considerable pixel area.” Col. 3, lines 21-34. This statement was made with reference to two storage sites on a pixel, but is equally applicable to two storage sites on the same chip with a pixel array, which would also decrease the potential fill factor (i.e., the amount of photosensitive area) on the chip. Thus, only when applying impermissible hindsight in consideration of the teachings of the present application, would one of ordinary skill in the art be motivated to combine Morris and Yadid as suggested in the Office Action.

Further, new claims 27 and 28 relate to an imaging system and method, respectively, where a first memory array on a first side of an imager array receives a first set

of signals from the imager array through a first analog to digital converter; a second memory array on an opposite side of the imager array receives a second set of signals from the imager array through a second analog to digital converter. This is not taught or suggested in the references of record. Specifically, Morris shows two register files 530, 550 for each block-column of pixel cells 510. The first register file 530 receives digital outputs of the ADC 520 and sends outputs to an ALU 540. The second register file 550 receives outputs from the ALU 540, which has processed the outputs from the first register file 530. This arrangement is vastly different from the claimed invention which has two memory arrays, each on a respective side of the pixel array which directly receives and stores output signals from the pixel array. This functionality is not possible in the memory arrangement taught by Morris. Therefore, it would not have been obvious to rearrange the register files of Morris as suggested by the Office Action as to attain the claimed invention. For at least this additional reason, allowance of claims 27 and 28 is requested.

Claim 11 stands rejected under 35 USC 103(a) as being unpatentable over Morris in view Yadid and further in view of U.S. Patent No. 5,248,971 to Mandl ("Mandl"). The rejection is traversed. For whatever Mandl teaches regarding oversampling an A/D converter, Mandl does not provide the teachings or objective motivation that is necessary and lacking for combining Morris and Yadid.

Claim 14 stands rejected under 35 USC 103(a) as being unpatentable over Morris in view Yadid and further in view of U.S. Patent No. 6,466,265 to Lee ("Lee"). The rejection is traversed. For whatever Lee teaches regarding a preamplifier with adjustable gain, Lee does not provide the teachings or objection motivation that is necessary and lacking for combining Morris and Yadid.

In view of the above remarks, applicant believes the pending application is in condition for allowance. Favorable action on claims 9-23 and 25-28 is solicited.

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